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# APPLICATION FOR UNITED STATES LETTERS PATENT

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**FOR:** MECHANICAL PENCIL

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# MECHANICAL PENCIL

## BACKGROUND OF THE INVENTION

### *Field of the Invention*

The present invention relates to a mechanical pencil and, more particularly, to a mechanical pencil in which a lead can be used effectively and the remainder lead can be shortened.

### *Description of the Related Art*

In a conventional mechanical pencil having a barrel, a lead feeding mechanism disposed in the barrel to tighten and feed a lead, a lead holder disposed on the tip end side of the lead feeding mechanism to hold the lead penetrating therethrough, and an operating part for causing the lead feeding mechanism to feed the lead, the lead is normally tightened by the lead feeding mechanism. Thus, the lead is prohibited from moving.

When the lead is projected from the tip end of the barrel at the time of writing, the operating part is operated to cause the lead feeding mechanism to feed the lead. At this time, since the lead is held by the lead holder, the lead that has been fed a predetermined amount during the lead feeding operation by the lead feeding mechanism, is prevented from retreating (e.g., retracting) together with the lead feeding mechanism when the lead feeding mechanism returns. Since the lead feeding

mechanism tightens the lead after returning, the lead projecting from the tip end of the barrel is used for writing without being retreated (retracted) by a writing force.

However, in the above-mentioned conventional mechanical pencil, when the lead is consumed, and thus the length thereof becomes shorter than a distance from the lead feeding mechanism to the tip end of the barrel, the lead is undesirably released from the tightening of the lead feeding mechanism. Thus, there arises a problem in that the consumed lead cannot be used effectively.

Specifically, for example, when the consumed lead is fed, the next lead is fed by the lead feeding mechanism so that the consumed lead is pushed out by using the next lead. However, since the next lead is not held by the lead holder, the feeding of lead is not performed completely, so that the consumed lead cannot be pushed out surely in some cases. In particular, when the lead is fed in an upward position of the pencil, such a phenomenon often occurs.

As a result, the lead that has become shorter than the distance from the lead feeding mechanism to the tip end of the barrel cannot be used sufficiently, and therefore becomes a remainder lead, which leads to a waste of resources.

## SUMMARY OF THE INVENTION

In view of the foregoing and other problems, drawbacks, and disadvantages of the conventional structures, an object of the present invention is to provide a mechanical pencil in which the length of remainder lead can be decreased greatly.

To achieve the above and other objects, a mechanical pencil according to the present invention includes a barrel, a lead feeding mechanism disposed in the barrel to tighten and feed a lead, and an operating part for causing the lead feeding mechanism

to feed the lead. The holding portions for holding the lead are provided in at least two places between the lead feeding mechanism and the tip end of the barrel spacedly (e.g., in a spaced configuration) in the axial direction.

When the lead is consumed, and thus the length thereof becomes shorter than a distance between the lead feeding mechanism and the tip end of the barrel, the holding portion provided at the front in the axial direction of the holding portions provided in at least two places holds the consumed lead, and the holding portion provided at the rear in the axial direction holds the next lead.

Thus, when the next lead is fed by the lead feeding mechanism, the next lead is surely fed by the holding portion provided at the rear. Hence, the next lead fed surely pushes out the consumed lead, so that the consumed lead is surely fed. Thus, the consumed lead can be used sufficiently. Specifically, as long as at least the holding portion provided at the front can hold the consumed lead, the consumed lead can be used, so that the length of remainder lead can be decreased greatly.

Also, in the mechanical pencil, a lead holder having a through hole through which the lead penetrates can be provided closer to the tip end than the lead feeding mechanism in the barrel, and the holding portions are provided on the lead holder.

By providing the holding portions on the lead holder, the mechanical pencil can be manufactured without increasing the number of parts. Also, since at least two holding portions are provided on the lead holder spacedly in the axial direction, the axial length of the lead holder increases resultantly, so that the length of the penetrating lead surrounded by the lead holder increases. Therefore, unintended decentering of the lead can be prevented, and thus the lead is prevented from being broken.

The present disclosure relates to subject matter contained in Japanese Patent

Application No. 2001-3113, filed on January 10, 2001, which is expressly incorporated herein by reference in its entirety.

## BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other purposes, aspects and advantages of the present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limiting the present invention, wherein:

FIG. 1 is a longitudinal sectional view of an essential portion of a mechanical pencil in accordance with an embodiment of the present invention;

FIG. 2 is an enlarged sectional view of a tip end member 14 and a slider 50; and

FIG. 3 is a plan view of FIG. 2.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

An embodiment of the present invention will now be described with reference to the accompanying drawings. FIGS. 1 to 3 show an embodiment of the present invention.

Referring to FIG. 1, a mechanical pencil has mainly a barrel 10, a lead feeding mechanism 20 disposed in the barrel 10 to tighten and feed a lead, a lead holder 50 disposed on the tip end side of the lead feeding mechanism 20 to hold the lead

penetrating therethrough, and an operating part (not shown) for causing the lead feeding mechanism 20 to feed the lead.

The barrel 10 includes a front barrel 12, a tip end member 14 screwed into the front barrel 12, and a rear barrel (not shown). A gripper 18 made of an elastic material is mounted on the outer peripheral face of the front barrel 12. The front barrel 12, the tip end member 14, and the rear barrel can be formed integrally (e.g., a unitary construction), or can be formed of more parts than in this embodiment. An opening 14a at the tip end of the tip end member 14 serves as an opening at the tip end of the barrel 10 to allow the lead to pass through.

The lead feeding mechanism 20 can have any construction. In this embodiment, the lead feeding mechanism 20 includes a lead containing cylinder 22 for containing the lead, a chuck 24 fixed at the tip end of the lead containing cylinder 22 to tighten and feed the lead, a chuck ring 26 located around the outer periphery of the chuck 24 to tighten the chuck 24, a sleeve 28 for preventing the rearward movement of the chuck ring 26, and a chuck spring 30 located between the sleeve 28 and the lead containing cylinder 22 to urge the lead containing cylinder 22 and the chuck 24 rearward.

To the rear end of the lead containing cylinder 22 is detachably connected a rear end pushbutton, which is the operating part. By knocking the rear end pushbutton, the lead containing cylinder 22, the chuck 24, and the chuck ring 26 of the lead feeding mechanism 20 are advanced, by which the lead is fed a predetermined amount. The operating part is not limited to the rear end pushbutton, and can be a side lever provided on the side face of the barrel 10.

The tip end member 14 contains a slider 50 (e.g., which is the lead holder), and a tip 52. In this embodiment, the tip 52 and the slider 50 can be slid in the axial

direction, and the tip 52 and the slider 50 can be projected together with the lead from the opening 14a at the tip end of the tip end member 14 or can be retreated (retracted) into the opening 14a at the tip end. It is a matter of course that the tip 52 and the slider 50 need not be slidable in the axial direction, and that they can be applied to a mechanical pencil of a type such that the tip and slider are not slidable in the axial direction.

As shown in greater detail in FIGS. 2 and 3, the slider 50 has a substantially cylindrical body 50b formed with a through hole 50a through which the lead penetrates, an outside cylinder 50c provided concentrically on the outside of the body 50b at the rear end part of the body 50b, and a connecting part 50d for connecting the outside cylinder 50c to the body 50b in the radial direction.

In the front end part of the body 50b, at least one blade 50e projecting in the inside diameter direction is formed, and also in the rear end part of the body 50b, a rib 50f projecting in the inside diameter direction is formed on the inner peripheral face of the through hole 50a. Also, a slit 50h is formed in a portion in which the rib 50f is absent at the rear end part of the body 50b formed with the rib 50f of the slider 50. Thus, the rib 50f can be displaced elastically in the radial direction. Similarly, on the outer peripheral face of the outside cylinder 50c, a rib 50g projecting in the outside diameter direction is formed, and a slit 50i is formed in a portion in which the rib 50g of the outside cylinder 50c is absent. Thus, the rib 50g can be displaced elastically in the radial direction.

The blade 50e and the rib 50f come into contact with the lead passing through the through hole 50a, and thereby hold the lead with a proper holding force. Also, the rib 50g of the outside cylinder 50c comes into contact with the inner peripheral face of the tip end member 14, and thereby maintains the positional relationship with the

tip end member 14 with a proper holding force. The blade 50e may be replaced with a rib similar to the rib 50f.

Although the slits 50h and 50i are not necessarily needed, a stable holding force can be obtained by the provision of slits 50h and 50i. The maximum static friction force generated between the rib 50g and inner peripheral face of the tip end member 14 is set to be larger than a sum of the maximum static friction force generated between the blade 50e and the lead, and the maximum static friction force generated between the rib 50f and the lead.

In the above-described mechanical pencil, when the lead is not consumed, the lead is held by the blade 50e and the rib 50f of the slider 50 in portions located ahead of a portion in which the lead is tightened by the chuck 24 of the lead feeding mechanism 20. The rest of the configuration of the pencil is the same as that of the conventional mechanical pencil, so that the explanation thereof is omitted.

When the lead is consumed, and thus the length thereof becomes shorter than a distance between the chuck 24 of the lead feeding mechanism 20 and the opening 14a at the tip end of the tip end member 14 as shown in FIGS. 1 and 2, a consumed lead L1 is held by the blade 50e of the slider 50, and the next lead L2 is held by the rib 50f of the slider 50. Therefore, the consumed lead L1 is prevented from dropping by the blade 50e.

When the operating part is operated in this state to feed the next lead L2 using the lead feeding mechanism 20, since the next lead L2 is held by the rib 50f of the slider 50, the lead L2 is surely fed by a predetermined amount without being pulled back together with the chuck 24 when the chuck 24 returns. Therefore, the consumed lead L1 is pushed out according to the fed amount, so that the consumed lead L1 can be fed surely. Even if the next lead L2 is fed in an upward position of the

pencil, the consumed lead L1 is fed surely in the same way.

Since the consumed lead L1 can be used in this manner, the length of remainder lead can be decreased significantly (e.g., almost completely as shown in Figure 2). Preferably, an axial distance between the blade 50e and the rib 50f is set as long as possible to hold the consumed lead L1 and the next lead L2. In this case, as a result, the length of the slider 50 is increased. Therefore, even if the lead is not consumed, the lead is protected against unintended decentering by the slider 50, so that the lead is prevented from being broken. It is noted that, instead of providing the blade 50e and the rib 50f on one component as holding portions as in the above-described embodiment, each of these elements can be provided on an individual separate component.

With the invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art intended to be included within the scope of the following claims.

For example, while the above described embodiment has been exemplarily described with respect to a mechanical pencil having a lead, other writing instruments having a consumable writing medium and which rely on the consumable writing medium being held by a holding portion, could find great benefit with the invention.